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APPLIED MATERIALS, INC.
2881 SCOTT BLVD. M/S 2061
SANTA CLARA, CA 95050

EXAMINER	
DEO, DUY VU NGUYEN	
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BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Application Number: 09/905,172
Filing Date: July 13, 2001
Appellant(s): MUI ET AL.

David B. Bonham
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed 12/20/04.

(1) Real Party in Interest

A statement identifying the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of the claims contained in the brief is correct.

(4) Status of Amendments After Final

No amendment after final has been filed.

(5) Summary of Invention

The summary of invention contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection (the issues) in the brief is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

The following is a listing of evidence relied upon in the rejection of claims under appeal.

6,452,274	Hasegawa et al.	9-2002
6,083,815	Tsai et al.	7-2000
6,200,881	Lou	3-2001
5,976,769	Chapman	11-1999
5,873,984	Cheng et al.	2-1999

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

1. Claims 8-11, 13, 15-21, 27-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang (US 6,171,940) and Hasegawa et al. (US 6,452,274).

Huang describes a method for forming a semiconductor device comprising: providing a substrate structure; forming an organic layer with low dielectric constant over the substrate; depositing a dielectric layer, SiON, over the organic layer; providing a patterned photoresist (claimed organic photoresist: please see cited art below) over the dielectric layer; etching the dielectric layer with dry etch (claimed first plasma etching) until apertures are formed in the dielectric layer; etching the organic layer using an anisotropic etching (claimed second plasma etching) until apertures are formed in the organic layer (col. 2, line 47-col. 3, line 17). Unlike claimed invention, Huang doesn't describe the organic low dielectric layer is formed by CVD and comprising carbon and hydrogen. Hasegawa describes a method for forming an organic low dielectric layer by PECVD and using material such as fluorinated ethylene propylene. This would form an organic layer comprising carbon and hydrogen (col. 3, line 20, 48; col. 8, line 65-col. 9, line 11). It would have been obvious for one skill in the art to form the organic low

dielectric layer in light of Hasegawa because Hasegawa further teaches method that is silent in Huang to form an organic low dielectric layer with a reasonable expectation of success.

Referring to claim 13, using propylene gas would be obvious since Hasegawa also describe using PECVD system for deposition (col. 9, line 8).

Referring to claim 15, 16, Hasegawa describes the etching gas for the organic layer comprising O2 (col. 10, line 16, 17).

Referring to claim 21, Huang describes the substrate structure being etched comprising polysilicon (claimed silicon layer).

Referring to claim 18, Huang further describes removing the organic layer after the substrate structure is etched (col. 3, line 39-44). Referring to claims 19 and 28, Hasegawa further teaches gases that remove the organic layer comprises O2 (col. 10, line 16, 17).

Referring to claims 10 and 11, Hasegawa describes etching the dielectric layer, including silicon oxide, silicon oxynitride, using fluorocarbon-containing species (col. 9, line 59-col. 10, line 25).

2. Claims 22-24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang and Hasegawa as applied to claim 21 above, and further in view of Tsai et al. (US 6,083,815).

Referring to claim 22-24, Huang describes the substrate structure comprising a silicon substrate (claimed single crystal silicon), an oxide layer over the silicon substrate, a doped polysilicon over the oxide layer (col. 2,line 47-60). Prior art of Huang and Hasegawa doesn't describe the substrate further comprising a native oxide layer over the doped polysilicon layer and etching the native oxide and the doped polysilicon layer using 2 etching plasma that comprises a halogen containing species. Tsai describes a same method for etching a substrate to

form a gate stack in which the doped polysilicon layer includes a native oxide and etching the native oxide and the doped polysilicon layer using 2 etching plasma processes that comprise halogen containing species to form a gate stack (col. 6, line 3-15, col. 7, line 1-6, 38-52). It would have been obvious for one skill in the art at the time of the invention to etch the polysilicon in light of Tsai further describes specific gases to etch the polysilicon and its native oxide with a reasonable expectation of success.

3. Claims 25, 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang and Hasegawa as applied to claim 21 above, and further in view of Lou (US 6,200,881).

Referring to claims 25 and 26, applied prior art of Huang and Hasegawa doesn't describe the substrate further comprising a single crystal silicon layer (will be referred as silicon layer), an oxide layer over the silicon layer, and a silicon nitride layer over the oxide layer wherein the silicon, oxide, and nitride layer are etched by one or more plasma etching steps comprising oxygen and halogen containing species. Lou describes a method for etching a substrate which comprising a silicon layer, an oxide layer over the silicon layer, and a silicon nitride layer over the oxide layer, wherein the silicon, oxide, and nitride layer are etched by one or more plasma etching steps comprising oxygen and halogen containing species (col. 3, line 50-col. 4, line 15). It would have been obvious for one skill in the art to modify the substrate of combined method above in light of Lou because depending on the type of substrate structure being made, shallow trench isolation can be formed by Lou's method.

4. Claims 30, 31, 33, 34 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang and Hasegawa, and further in view of Chapman (US 5,976,769).

Applied prior art of Huang and Hasegawa doesn't describe etching portions of the organic layer to reduce the width of the organic layer. However, Huang teaches of reducing the photoresist width so that the width of the organic layer can also be smaller (col. 3, line 7-15). Chapman describes a method for providing sublithographic patterns wherein the exposed sidewalls of the organic layer is etched such that the width of the organic layer is reduced at the substrate using etching technique including plasma etch (figure 8a-8d; col. 5, line 15-col. 6, line 7). It would have been obvious for one skill in the art at the time of the invention to modify applied prior art method in light of Chapman's method of etching the exposed sidewalls of the organic layer because Chapman shows that it is also provide the same result as reducing the photoresist (third embodiment) and it would provides a smaller linewidth than using conventional lithographic process and a smaller linewidth would be desired in fabrication of semiconductor circuits with high device density according to Chapman (col. 1, line 10-40).

5. Claims 14, 32, 35-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Huang/Hasegawa or Huang/Hasegawa/Chapman as applied to claims 8, 17, 27, 30 above, and further in view of Cheng et al. (US 5,873,984).

Unlike claimed invention, applied prior art of Huang/Hasegawa or Huang/Hasegawa/Chapman doesn't describe the organic layer has 70-80 % of carbon, 10-20% hydrogen, and 5-15 % of nitrogen. Cheng describes a method for forming an organic layer (amorphous carbon layer) having carbon, hydrogen, and nitrogen, where in the ratio of nitrogen and hydrogen is from 0.5-1.0 (col. 2, line 26, 27, col. 5, line 5, 6). It would have been obvious to one skill in the art in light of Cheng to add nitrogen because Cheng teaches that the resultant nitrogen and hydrogen improved characteristics in both mechanical property and tribological

performance of the organic layer (col. 2, line 18-35). Furthermore he also the teaches to determine the ratio of the chemicals in the organic layer through routine experimentation because he shows that the chemical concentration is result-effective variable as he tests different ratios of the nitrogen and hydrogen through test runs so that optimum ratio can be obtain to provide optimum result (col. 5, line 3-6) wherein the nitrogen and hydrogen concentration are similar.

(10) Response to Argument

Referring to appellants' argument that Hasegawa teaches away from the claim limitations since he suggests the CVD is useful for amorphous carbon and nothing is stated concerning the hydrogen content, as shown in col. 9, line 5-8, the amorphous carbon layer maybe formed by using acetylene, which would be a hydrocarbon specie and create a layer with carbon and hydrogen. Also, Hasegawa's teaching is used to show a depositing method, which is silent in Huang and that the CVD method is known to one skilled in the art at the time of the invention to deposit material such as organic layer, used by Huang. Since Huang is silent with respect to the method of deposition, in the absence of unexpected result, one of ordinary skilled in the art would have been motivated to employ any method that is known to accomplish the desired deposition, including CVD.

In response to appellants' argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the

applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

Referring to appellants' argument that the office action does not explain why one skilled in the art would be motivated to select this particular material for use in Huang, as opposed to the myriad other low k dielectric constant organic layers known in the art, the reason for combining the references is not about why Hasegawa's materials should be chosen against other organic materials known in the art since other known organic materials in the art at the time of the invention can also be used since Huang suggests to use an organic layer. The motivation is that Hasegawa provides the techniques and materials, known to one skilled in the art at the time of the invention, that is silent in Huang in order to form an organic layer.

Referring to appellants' argument that a layer useful as an interlayer insulating material would by no means provide a reasonable expectation that the same material can be successfully employed as a masking layer, this does not response to the rejection because it is combined not as a masking layer. Furthermore, the low k organic layer is not a masking layer in the claims but a part of a multiplayer structure that called masking structure by the applicant. It is obvious that any structure that has the same layers would also read on claimed masking structure.

Appellants' argument that the office action motivation of adding the low k material from Hasegawa into Huang is a suggestion of "obvious to try" of using one of the low k dielectric layer taught in Hasegawa as an masking layer as taught in Huang is not persuasive. Huang boardly teaches using a low k organic material. In the absence of unexpected result, one of ordinary skilled in the art would be motivated to employ any known low k dielectric material (organic layer), including those disclosed by the secondary reference of Hasegawa who provide

techniques and material, known to one skilled in the art at the time of the invention, that is silent in Huang in order to form an organic layer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

DVD
March 7, 2005

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For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

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March 4, 2005

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